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FOREST PEST MANAGEMENT

Incidence of Armillaria Root Disease in Regenerated Lodgepole Stands in Western Colorado

By

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Forest Pest Management
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Timber, Forest Pest, and
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INTRODUCTION

Root diseases can potentially affect the productivity and management of young commercial forest stands. These diseases may impact stands by causing mortality and growth loss. Little is known about the identity, distribution,and impact of root diseases in the Rocky Mountain Region.

The most widely distributed root pathogen in the Region is probably Armillaria sp. This fungus has an extremely wide host range, including the following tree species in the Rocky Mountains: subalpine fir, white fir, lodgepole pine, ponderosa pine, pinyon, Rocky Mountain juniper and Engelmann spruce.

Because of the possible impact of this disease in young commercial stands, a study was conducted to determine disease development over time within selected stands of lodgepole pine.

MATERIALS AND METHODS

Stand characteristics and location are delineated in Table 1 and Figure 1. For comparison of disease frequency and distribution within a stand, transect surveys were made in 1979 and 1987. In 1979, along transects, fixed-radius plots were established every chain. The plots were 0.01 acre in size if there were 10 or more trees per plot, and 0.1 acre if there were less than 10 trees per plot. Transects were run one chain apart. In 1987, because of the distribution of the trees, 0.1 acre plots were established every two chains along a transect. (Pre-commercial thinnings had been made between 1984 and 1986.) Transects were run two chains apart.

In 1979, at least four plots were established in each stand to study disease epidemiology. The Plots are listed in the Appendix.

Table 1. Characteristics of commercial stands selected for survey of incidence and distribution of root disease.

Site	National Forest	Ranger District	Legal Description	Species	Site Factors 1/				
					Basal Area per Acre	Site Index 2/	Ave. DBH (inches)	Ave. Hgt (feet)	Ave. Age (years)
Mill Creek	Routt	Hahn's Peak	T10N, R86W, Sec. 34	Spruce-fir	85	40	7.8	40.7	86
Powderhouse	Gunnison	Cebolla	T50W, R4E, Sec. 22	lodgepole pine	115	40	8.6	51.3	185
Canyon Creek	Gunnison	Cebolla	T50N, R4E, Sec. 36	lodgepole pine	75	30	6.7	39.8	83
Last Chance	White River	Sopris	T8S, R83W, Sec. 14	lodgepole pine	90	40	8.0	45.6	90

1/ From at least six dominant/codominant trees adjacent to the sample site.

2/ Site index base = 100 years

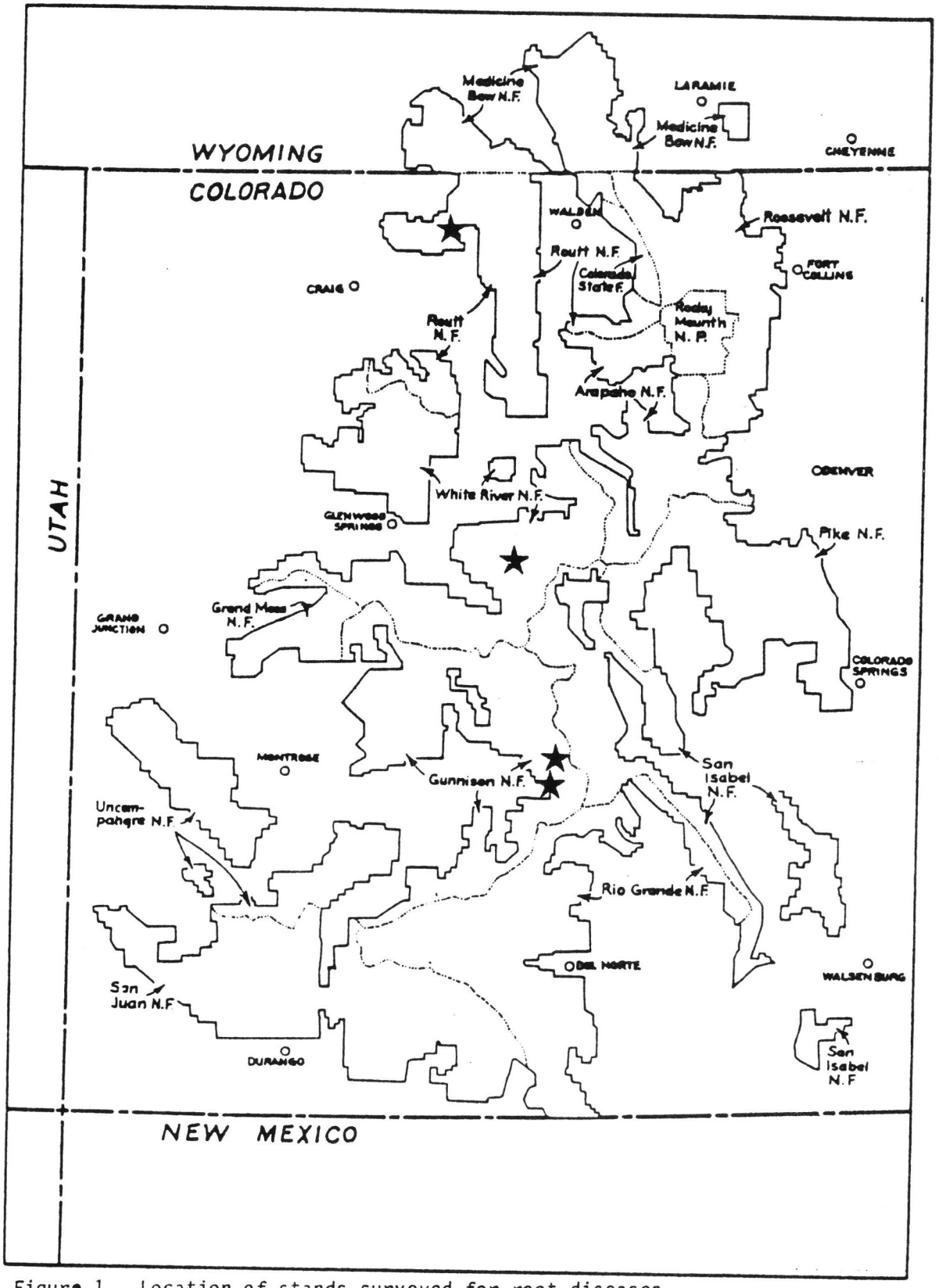

Figure 1. Location of stands surveyed for root diseases. (★=stands surveyed)

RESULTS AND DISCUSSION

Armillaria sp. was the only pathogen searched for in the four stands sampled. Other pathogenic organisms may have occurred singly or in conjunction with Armillaria sp., however, none were recorded. Identification of root disease caused by Armillaria sp. in the field was based on visual symptoms and signs. These included foliage color, resin exudation, wood impregnation around the root collar, mycelial fans, rhizomorphs or sporphores.

The average incidence of Armillaria sp. in three of the four stands examined decreased from 1979 to 1987 (Table 2). Mill Creek (Routt National Forest) was the exception. In 1979, 1.7 percent of the transect surveyed trees were infected at Mill Creek. This increased to 4.6 percent in 1987. Although lodgepole pine is the managed species at Mill Creek, there are numerous subalpine firs scattered through the stand. Fifty-six percent of the infected trees were subalpine fir in 1987 (Table 1-insert).

In 1987 the incidence of Armillaria sp. ranged from 0.2 percent at Canyon Creek (Gunnison National Forest) to 8.1 percent at Last Chance (White River National Forest). Although the disease incidence appears to be declining at Last Chance, it continues to have the highest incidence of the four stands sampled.

The average decrease in disease incidence for the three stands, Last Chance, Canyon Creek, and Powderhouse (Gunnison National Forest), was 2.7 percent. It appears disease incidence is declining.

Examination of 1979 data from the intensive plots (James and Gillman, 1980) shows that the incidence of disease was three times that determined by transect plots. Whether the 1987 intensive plot data, when compared with the ratio of 1979 transect to intensive plot data, supports the decline indicated by the 1987 transect data is not certain.

Between 1979 and 1987, tree removals occurred in the intensive plots by Christmas tree cutters, tree diggers, rodents and a precommercial thinning. By 1984, trees missing from the sample population from one or more causes were 54% at Canyon Creek, and 16% at Mill Creek. By 1987, all the stands had been thinned. Consequently, we cannot determine if the incidence pattern for intensive plots would support the disease decline indicated by the 1987 transect data.

Based strictly on comparison of data for transects, it appears the incidence of Armillaria sp. is decreasing in the stands examined, except for Mill Creek. Similar declines in incidence of Armillaria root disease in conifer stands in Colorado have been observed by others (personal communication). We do not feel there should be further concern for Armillaria sp. in the stands examined at Canyon Creek and Powderhouse. Since infected live trees were found at Mill Creek and Last Chance, we will continue to monitor these stands.

TABLE 2. THE INCIDENCE OF ARMILLARIA ROOT DISEASE IN REGENERATED LODGEPOLE STANDS IN WESTERN COLORADO BASED ON 1979-1987 TRANSECT DATA

SITE	FOREST	AREA SURVEYED ACRES	TOTAL TREES SAMPLED	NUMBER ROOT DISEASED TOTAL	NUMBER ROOT DISEASED LIVE	NUMBER ROOT DISEASED DEAD	PERCENT ROOT DISEASED TOTAL	PERCENT ROOT DISEASED LIVE	PERCENT ROOT DISEASED DEAD	NUMBER DISEASED TREES PER ACRE
Mill Creek1/	Routt									
1979		13	582	10	NA	NA	1.7	NA	NA	0.8
1987		13	539	25 2/	2	23	4.6	0.4	4.2	1.9
Powderhouse	Gunnison									
1979		6.9	786	19	NA	NA	2.4	NA	NA	2.8
1987		6.9	748	9	0	9	1.2	0	1.2	1.3
Canyon Creek	Gunnison									
1979		6.2	582	24	NA	NA	4.1	NA	NA	3.9
1987		6.2	460	1	0	1	0.2	0	0.2	0.2
Last Chance	White River									
1979		4.5	536	60	NA	NA	11.2	NA	NA	13.3
1987		4.5	442	36	2	34	8.1	0.4	7.7	8.0

1/ Mill Creek is a mixed stand of lodgepole pine and subalpine fir. It is managed for the former.

2/ Incidence of root diseased trees in Mill Creek sample by species.

2/ SPECIES	LIVE	INFECTED DEAD
SAF	0	14
LP	2	9

LITERATURE CITED

James, R.L. and L.S. Gillman. 1980. Root disease surveys of selected managed conifer stands on the Routt, Gunnison and White River National Forests in Colorado. USDA Forest Service, State and Private Forestry, Rocky Mountain Region, Bio. Eval. R2-80-2, 21 p.

Canyon Creek Evaluation Plots

Cebolla R. D., Gunnison N.F.

Plot #1 Plot center (stump - tag #1) is 469 feet at 31° from a painted tree at the road intersection
Tag # 1 - 94

Plot #2 Plot center (stump - tag #95) is 386 feet at 349° from the center of Plot #1
Tag # 95 - 174

Plot #3 Plot center (stump - tag #175) is 352 feet at 20° from the center of Plot #2
Tag # 175 - 238

Plot #4 Plot center (stump - tag #239) is 386 feet at 11° from the center of Plot #3
Tag # 239 - 360

Plot #5 Plot center (stump - tag #361) is 402 feet at 47° from the center of Plot #4
Tag # 301-396

Plot #6 Plot center (stump - tag #397) is 141 feet at 234° from painted tree (orange horizontal stripes) south of Stridiron Creek Road
Tag # 397 - 461

Powderhouse Evaluation Plots

Cebolla R.D., Gunnison N.F.

Plot #1 Plot center (stump - tag #1) is 245 feet at 106° from a painted tree on the edge of a mature stand on the west side of the border road.
Tag # 1 - 28

Plot #2 Plot center (stump - tag #29) is 470 feet south of a painted tree on the left side of the border road, then 29 feet east of the road middle.
Tag # 29 - 100

Plot #3 Plot center (stump - tag #101) is 256 feet at 158° from the center of Plot #2
Tag # 101 - 196

Plot #4 Plot center (stump - tag #197) is 536 feet at 43° from the center of Plot #3
Tag # 197 - 318

Plot #5 Plot center (stump - tag #319) is 360 feet at 348° from the center of Plot #4
Tag # 319 - 351

Plot #6 Plot center (stump - tag #352) is 62 feet at 63° from the center of Plot #5
Tag # 352 - 384

Mill Creek Evaluation Plots

Hahn's Peak R.D., Routt N.F.

Plot #1 Painted site stump is 0.4 miles west of Mill Creek. Plot center (stump - tag #1) is 92 feet at 184° from the painted site stump.
Tag # 1 - 73

Plot #2 Plot center (stump - tag #75) is 330 feet at 160° from the center of plot #1.
Tag # 74 - 103

Plot #3 Plot center (stump - tag #104) is 287 feet at 141° from the center of plot #2
Tag # 104 - 144

Plot #4 Plot center (stump - tag #145) is 507'7" at 92° from the center of plot #3
Tag # 145 - 229

Plot #5 Plot center (stump - tag #230) is 446' at 100° from the center of plot #4
Tag # 230 - 282

Last Chance Evaluation Plots

Sopris R. D., White River N. F.

Plot #1 Plot center (stump - tag #1) is 47 feet at 62° from a flagged aspen south of the road
Tag # 1 - 70

Plot #2 Plot center (stump - tag #71) is 162 feet at 122° from the center of Plot #1
Tag # 71 - 300

Plot #3 Plot center (stump - tag #301) is 138 feet at 60° from the center of Plot #2
Tag # 301 - 969

Plot #4 Plot center (stump - tag #970) is 244 feet at 22° from the center of Plot #3
Tag # 970 - 1000, 101.